

## **REMARKS**

Claims 1 through 35 are now pending in the application. The Examiner is respectfully requested to reconsider and withdraw the rejections in view of the amendments and remarks contained herein.

### **REJECTION UNDER 35 U.S.C. § 112**

Claims 2-5, 15, 17-19, 25-28, and 32 stand rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point and distinctly claim the subject matter which Applicant regards as the invention. This rejection is respectfully traversed.

First, Applicant has made a non-narrowing minor amendment to claim 15 to change liquid couplant to liquid detection medium. Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection of claim 15 under 35 U.S.C. §112, second paragraph.

With respect to claims 2-5, 17-19, 25-28, and 32, the Patent Office contends that the term “cold signature” is a relative term that renders these claims indefinite. Applicant respectfully disagrees, and first directs the Examiner’s attention to MPEP §2173.05(b) which states:

The fact that claim language, including terms of degree, may not be precise, does not automatically render the claim indefinite under 35 U.S.C. 112, second paragraph. *Seattle Box Co., v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 221 USQP 568 (Fed. Cir. 1984). Acceptability of the claim language depends on whether one of ordinary skill in the art would understand what is being claimed, in light of the specification.

When a term of degree is presented in a claim, first a determination is to be made as to whether the specification provides some standard for measuring that degree.

Applicant further notes that the application as originally filed provides sufficient information to enable one having ordinary skill in the art to readily understand the meaning of the term “cold signature”. See, for example, paragraph [0014] of the specification, which states:

Another example of a defect signature is a cold signature produced by a cooling effect of the agitated couplant and/or by a cooling effect of ejected couplant as it evaporates. Detection of such a cold signature, for example with an infrared camera, indicates existence of a defect in the test specimen.

See also, for example, paragraph [0016] stating:

The system 100 also includes an infrared camera 112 for detecting cold signatures produced by a cooling effect of the agitated couplant and/or by a cooling effect of ejected couplant as it evaporates. Alternatively, a wide range of other devices and techniques can be used for detecting the defect signatures or vibration effects of the liquid couplant in response to the excitation including high speed photography, videography for motion analysis, specialized lenses, high speed analysis lighting, video imaging technologies, and specialized techniques such as Schlieren, streak, and pulsed laser illumination.

Further examples are set forth in paragraphs [0022] and [0023] as follows:

The cooling effect of the agitated couplant and/or of the atomized couplant 136 as it evaporates produces cold signatures which can be detected by the infrared camera. For example, ejected couplant 136 cools by evaporation and thus appears cold relative to the surface portion 124 in the infrared images acquired by the infrared camera 112.

Analyzing the infrared images for cold signatures can be performed manually by an inspector, automatically by a processor, a combination thereof, etc. Infrared images can also be analyzed to detect mode patterns of excitation in addition to detecting cold signatures.

Additional examples are set forth in original claims 3, 18, 25, and 32. For example, claim 3 recites "wherein the excitation of the test specimen causes liquid detection medium to be ejected from the test specimen at about the defect, the ejected liquid detection medium cooling by evaporation and producing the cold signature."

For the above reasons, Applicant respectfully submits that the meaning of "cold signature" as recited in claims 2-5, 17-19, 25-28, and 32 is sufficiently definite as to permit those skilled in the art to readily understand the scope of such claims. Accordingly, Applicant respectfully submit that claims 2-5, 15, 17-19, 25-28, and 32 are not indefinite, and request withdrawal of the rejection under 35 U.S.C. §112, second paragraph.

## **REJECTION UNDER 35 U.S.C. § 102 - NOVOTNY**

Claims 1-2, 4-7, 9-17, 19-24, 29-32, and 34-35 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Novotny (U.S. Pat. No. 6,487,907). This rejection is respectfully traversed.

At the outset, Applicant submits that the amendments to independent claims 1, 16, 29 and 34 have rendered moot the rejections thereto.

Claim 1 has been amended to clarify that “said monitoring including monitoring the liquid detection medium to detect a temperature differential indicative of a defect in the test specimen.” These features are not disclosed by Novotny, and accordingly Novotny cannot anticipate claim 1.

Claim 16 has been amended to clarify that the method can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the method includes monitoring the liquid couplant for an ejection of liquid couplant from the first surface portion. These features are not disclosed by Novotny, and accordingly Novotny cannot anticipate claim 16.

Claim 29 has been amended to clarify that the system can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the system includes a device capable of detecting defect signatures produced by the liquid couplant in response to the excitation “including at least one of an ejection of liquid couplant from the test specimen and a temperature differential indicative of a defect in the test specimen.” These features are not disclosed by Novotny, and accordingly Novotny cannot anticipate claim 29.

Claim 34 has been amended to clarify that the system can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the system includes means for detecting defect signatures produced by the liquid couplant “including at least one of an ejection of liquid couplant from the test specimen and a temperature differential indicative of a defect in the test specimen”. These features are not disclosed by Novotny, and accordingly Novotny cannot anticipate claim 34.

Novotny merely discloses a liquid coupling (water) that is put between a lens and sample, such that a short sound pulse sent by the lens towards the sample produces a first pulse reflecting from the liquid and a second pulse reflecting from the sample. Time

resolved images may be derived from the time delay between pulses to produce a section view through the sample. (See column 16, lines 1-31). Novotny also discloses that a mechanical defect can manifest itself as an area with higher local temperature than the surrounding area when under excitation. (See Novotny, column 10, line 25). Thus, Novotny discloses thermal imaging to sense heat emitted directly from the sample itself to detect possible defects (see, for example, Novotny, column 12, lines 30-60), or acoustical images used to generate sectional views through a test sample (see also Novotny column 16, lines 4-31).

Nowhere does Novotny disclose, teach, or suggest systems or methods that include monitoring a liquid detection medium to detect a temperature differential within the liquid detection medium. Novotny also fails to disclose, teach, or suggest systems or methods capable of detecting defects in a test specimen independent from and without having to rely on heating of the test specimen itself. Novotny also fails to disclose, teach, or suggest methods that include monitoring a liquid couplant for an ejection of liquid couplant from the test specimen.

Accordingly, Applicant submits that Novotny does not disclose each and every feature of claims 1, 16, 29, and 34, and, accordingly, cannot anticipate these claims. For at least these reasons, Applicant submits that independent claims 1, 16, 29, and 34 are patentably distinguished from Novotny and respectfully request reconsideration and withdrawal of the Section 102(b) rejections.

Furthermore, Novotny also fails to recognize the advantages that may be realized with some exemplary systems and methods of the present disclosure that allow for detection of defects without relying on or requiring heating of the test specimen by the excitation source. As noted in Applicant's specification, various embodiments can detect defects by analyzing the vibration effects on the liquid couplant without relying on heat generation by vibration. In such exemplary embodiments, the excitation source does not need to dwell on the part surface to generate heat in the part, thus allowing a test specimen to be inspected with shorter excitation times and shorter pulse durations. This, in turn, can reduce the likelihood that a test specimen will be accidentally damaged from prolonged use of the excitation source.

With regard to claims 2, 4-7, 9-15, 17, 19-24, 30-32, and 35, these claims ultimately depend from independent claims 1, 16, 29, or 34, which Applicant believes to be allowable in view of the above remarks. As such, Applicant submits that claims 2, 4-7, 9-15, 17, 19-24, 30-32, and 35 are also allowable by virtue of their dependence from independent claims 1, 16, 25, 29, or 34.

In addition, claims 2, 4-7, 9-15, 17, 19-24, 30-32, and 35 are further patentably distinguishable over the cited documents in that the cited documents do not disclose, teach or suggest the additional features required by these claims. For example, Novotny does not disclose, teach, or suggest “thermally monitoring the liquid detection medium to detect cold signatures”, as required by claim 2. As another example, Novotny also fails to disclose, teach, or suggest “visually monitoring the liquid detection medium to detect the ejection of liquid detection medium from the test specimen”, as required by claim 9. A further example is Novotny’s failure to disclose, teach, or suggest “the liquid detection medium includes insoluble particles which form a visible pattern on the test specimen at about a defect after the excitation”, as required by claim 15. As yet another example, Novotny also does not disclose, teach or suggest “thermally monitoring the liquid couplant for a cold signature”, as required by claim 17. For these additional reasons, Applicant respectfully requests reconsideration and withdrawal of the rejections based on Novotny.

#### **REJECTION UNDER 35 U.S.C. § 102 - ROTHENFUSSE**

Claims 1-2, 4-7, 9-17, and 19-35 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Rothenfusser (DE 10147102 A1). This rejection is respectfully traversed.

At the outset, Applicant submits that the amendments to independent claims 1, 16, 29 and 34 have rendered moot the rejections thereto.

Claim 1 has been amended to clarify that “said monitoring including monitoring the liquid detection medium to detect a temperature differential indicative of a defect in the test specimen.” These features are not disclosed by Rothenfusser, and accordingly Rothenfusser cannot anticipate claim 1.

Claim 16 has been amended to clarify that the method can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the method includes monitoring the liquid couplant for an ejection of liquid couplant from the first surface portion. These features are not disclosed by Rothenfusser, and accordingly Rothenfusser cannot anticipate claim 16.

Claim 29 has been amended to clarify that the system can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the system includes a device capable of detecting defect signatures produced by the liquid couplant in response to the excitation “including at least one of an ejection of liquid couplant from the test specimen and a temperature differential indicative of a defect in the test specimen.” These features are not disclosed by Rothenfusser, and accordingly Rothenfusser cannot anticipate claim 29.

Claim 34 has been amended to clarify that the system can detect defects in a test specimen “without having to rely on heating of the test specimen” and that the system includes means for detecting defect signatures produced by the liquid couplant “including at least one of an ejection of liquid couplant from the test specimen and a temperature differential indicative of a defect in the test specimen”. These features are not disclosed by Rothenfusser, and accordingly Rothenfusser cannot anticipate claim 34.

Claim 25 recites a method of detecting defects in a test specimen, the method comprising “applying a liquid couplant to at least a first surface portion of the test specimen; acoustically exciting the test specimen to cause an ejection of liquid from the first surface portion at about a defect in the test specimen, the ejected liquid cooling by evaporation and producing a cold signature for said defect; and thermally monitoring the liquid couplant to detect cold signatures produced by the liquid couplant.” These features are not disclosed by Rothenfusser, and accordingly Rothenfusser cannot anticipate claim 25.

A review of the Rothenfusser reference reveals that Rothenfusser merely shows that a sound producing object (e.g., an ultrasonic sonotrode) creates acoustical waves in an object. The object includes a sound-absorbing layer formed of viscoelastic materials. Rothenfusser discloses that radiant heating or rise in temperature is seized

by an infrared camera to detect superficial microdamage in the test specimen. While Rothenfusser appears to disclose detection of a standing wave by a camera, Rothenfusser also relies upon and detects radiant heating (not cold signatures) produced by the vibrating the test specimen.

Rothenfusser does not, however, disclose, teach, or suggest systems or methods that include monitoring a liquid detection medium to detect a temperature differentials or a cold signature within the liquid detection medium. Rothenfusser also fails to disclose, teach, or suggest systems or methods capable of detecting defects in a test specimen independent from and without having to rely on heating of the test specimen itself. Rothenfusser also fails to disclose, teach, or suggest methods that include monitoring a liquid couplant for an ejection of liquid couplant from the test specimen.

Accordingly, Applicant submits that Rothenfusser does not disclose each and every feature of claims 1, 16, 29, and 34, and, accordingly, cannot anticipate these claims. For at least these reasons, Applicant submits that independent claims 1, 16, 29, and 34 are patentably distinguished from Rothenfusser and respectfully request reconsideration and withdrawal of the Section 102(b) rejections.

With regard to claims 2, 4-7, 9-15, 17, 19-24, 26-28, 30-33, and 35, these claims ultimately depend from independent claims 1, 16, 25, 29, or 34, which Applicant believes to be allowable in view of the above remarks. As such, Applicant submits that claims 2, 4-7, 9-15, 17, 19-24, 26-28, 30-33, and 35 are also allowable by virtue of their dependence from independent claims 1, 16, 29, or 34.

In addition, claims 2, 4-7, 9-15, 17, 19-24, 26-28, 30-33, and 35 are further patentably distinguishable over the cited documents in that the cited documents do not disclose, teach or suggest the additional features required by these claims. For example, Rothenfusser does not disclose, teach, or suggest “thermally monitoring the liquid detection medium to detect cold signatures”, as required by claim 2. As another example, Rothenfusser also fails to disclose, teach, or suggest “visually monitoring the liquid detection medium to detect the ejection of liquid detection medium from the test specimen”, as required by claim 9. A further example is Rothenfusser’s failure to disclose, teach, or suggest “the liquid detection medium includes insoluble particles

which form a visible pattern on the test specimen at about a defect after the excitation”, as required by claim 15. As yet another example, Rothenfusser also does not disclose, teach or suggest “thermally monitoring the liquid couplant for a cold signature”, as required by claim 17. For these additional reasons, Applicant respectfully requests reconsideration and withdrawal of the rejections based on Rothenfusser.

### **REJECTION UNDER 35 U.S.C. § 103**

#### ***Claims 3, 8, 18, and 25-28***

Claims 3, 8, 18 and 25-28 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Novotny (U.S. Pat. No. 6,487,907) and Rothenfusser (DE 10147102 A1). This rejection is respectfully traversed.

Independent claim 25 recites a method of detecting defects in a test specimen. The method includes “applying a liquid couplant to at least a first surface portion of the test specimen; acoustically exciting the test specimen to cause an ejection of liquid from the first surface portion at about a defect in the test specimen, the ejected liquid cooling by evaporation and producing a cold signature for said defect; and thermally monitoring the liquid couplant to detect cold signatures produced by the liquid couplant.” As recognized by the Office action, these features are not disclosed, taught, or suggested by either Novotny or Rothenfusser.

The Office action states that both the Novotny and Rothenfusser systems are capable of liquid couplant ejection, and that it is well known that standing wave generation will cause a liquid to be ejected. Even assuming *arguendo* that this is true, neither Novotny nor Rothenfusser further disclose, teach, or suggest each and every feature of claim 25. For example, neither Novotny nor Rothenfusser thermally monitoring the liquid couplant to detect cold signatures produced by the ejected liquid couplant. The cited patents also fail to even recognize that ejected liquid couplant can result in an evaporative or local cooling, or cold signature. For at least these reasons, Applicants respectfully request reconsideration and withdrawal of the obviousness rejection of claim 25.



With regard to claims 3, 8, and 18, these claims ultimately depend from an independent claim 1 or 16, shown above to be allowable. As such, Applicant submits that claims 3, 8, and 18 by virtue of their dependence from independent claim 1 or 16.

In addition, claims 3, 8, and 18 are further patentably distinguishable over Novotny and Rothenfusser because these cited patents do not disclose, teach or suggest the additional features required by these claims:

“wherein the excitation of the test specimen causes liquid detection medium to be ejected from the test specimen at about the defect, the ejected liquid detection medium cooling by evaporation and producing the cold signature” (as recited in claim 3); or

“wherein the vibrational mode pattern comprises an ejection of liquid detection medium from the test specimen at about the defect” (as recited in claim 8); or

“wherein the excitation of the test specimen causes liquid couplant to be ejected from the first surface portion at about a defect, the ejected liquid couplant cooling by evaporation and producing the cold signature” (as recited in claim 18).

## **CONCLUSION**

It is believed that all of the stated grounds of rejection have been properly traversed, accommodated, or rendered moot. Applicant therefore respectfully requests that the Examiner reconsider and withdraw all presently outstanding rejections. It is believed that a full and complete response has been made to the outstanding Office Action and the present application is in condition for allowance. Thus, prompt and favorable consideration of this amendment is respectfully requested. If the Examiner believes that personal communication will expedite prosecution of this application, the Examiner is invited to telephone the undersigned directly at (314) 726-7502.

Applicant believes that he does not owe any fee in connection with this filing. If, however, Applicant does owe any fee(s), the Commissioner is hereby authorized to charge the fee(s) to Deposit Account No. 08-0750. In addition, if there is ever any other fee deficiency or overpayment under 37 C.F.R. §1.16 or 1.17 in connection with this

patent application, the Commissioner is hereby authorized to charge such deficiency or overpayment to Deposit Account No. **08-0750**.

Respectfully submitted,

Dated: December 21, 2005

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